B. P. I.—427.

United States Department of Agriculture,
BUREAU OF PLANT INDUSTRY,
SEED DISTRIBUTION,
WASHINGTON, D. C.

BRIEF DIRECTIONS FOR THE CULTIVATION OF TOBACCO, 1909.

The following pages were prepared expressly to accompany each lot of tobacco seed sent out in the Congressional Seed Distribution of the United States Department of Agriculture.

The directions for the cultivation of cigar tobaccos were prepared by Mr. A. D. Shamel and those for the export and manufacturing types by Mr. E. H. Mathewson.

LISLE MORRISON,
Assistant in Charge of Seed Distribution.

Approved:

B. T. GALLOWAY,
Chief of Bureau.

WASHINGTON, D. C., *November 20, 1908.*

DISTRIBUTION OF TOBACCO SEED IN 1909.

A card has been inclosed with every lot of tobacco seed sent out, requesting each grower who can make a report of his test of the seed to sign and return the card. The card is franked and does not require postage. Upon its return to the Bureau of Plant Industry a blank form will be sent, upon which the report can be made.

The seed in the accompanying packets has been tested for vitality in triplicate tests and found to be high in germination. The seed of each variety has been obtained from growers who are located in the sections of country best adapted by reason of soil, climatic, and other conditions for the production of their particular varieties of tobacco. The seed has been saved under bag from selected plants, and all light or immature seeds have been blown out by means of an air blast used in the apparatus devised in the Bureau of Plant Industry.

FIG. 1.—Seed plant ready for bag.

Soil and climate are very important factors in determining the character of tobacco produced, and tobacco growers should exercise caution in using the seed received on anything more than a purely experimental scale until they see what the character of the product is under the new conditions of soil and climate. The small amount of seed inclosed in the package is intended only for experimental purposes, either to introduce the variety into a new section or to furnish a new strain in the old section. A new variety should not necessarily

be discarded upon one year's test, but in order to find out its real comparative value selections of the best plants should be made for at least three successive years.

As a general rule, however, it is recommended that the commercial grower stick to varieties developed in his own neighborhood. If a strain of tobacco has been grown continuously in one section for a long period and has been intelligently selected from the best plants, it tends to adapt itself to those conditions and become better suited for culture in that section. If a strain seems to run out after being in a certain section for a long period of years, it is quite likely due to poor seed selection and sowing rather than to any inherent inferiority in the strain itself. Much of the tendency of tobacco plants to run out is no doubt due to cross-fertilization with inferior plants. By placing an ordinary 12-pound manila-paper bag over the flower head just before the flowers begin to open all danger of injurious cross-pollination will be prevented. (See figs. 1 and 2.) All the side flower shoots should be removed before bagging, leaving only the central cluster, and if any flowers have opened already they should be removed before the bag is applied. It is necessary to raise the bag up the stalk every few days at first while the seed head is growing rapidly, in order to give it room. Bud worms should be carefully looked after and removed, and the débris of the flower parts as they wither and fall should be shaken out to prevent mold or other damage from an accumulation of damp material in the bag.

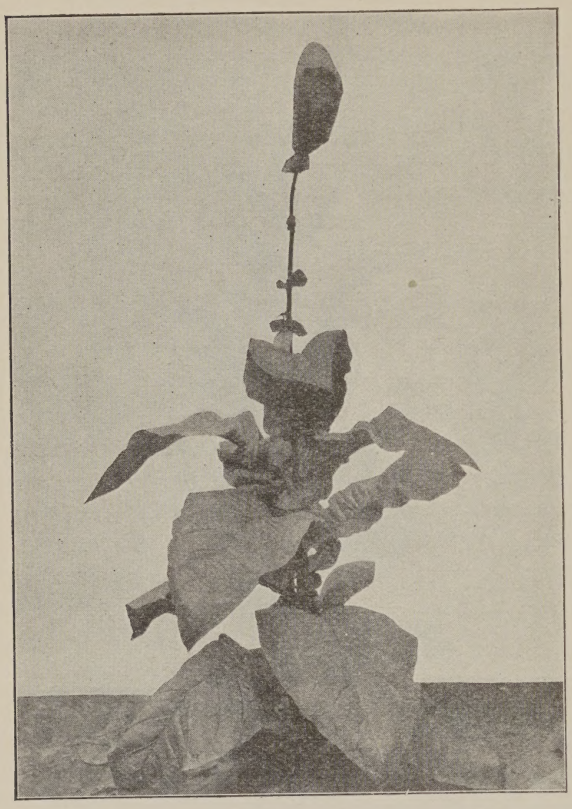

FIG. 2.—Proper arrangement of bag on seed plant.

It is important to sow only the thoroughly developed and heaviest seeds. Immature seeds produce a weak plant that will tend to blossom out before the plant has set a sufficient number of leaves to give

a satisfactory yield. All undeveloped and immature seed pods should be picked off and discarded at the time the seed heads are harvested. Most of the lighter seeds may then be removed by blowing or by separating with a specially devised apparatus now on the market. Such machines are in the possession of most of the agricultural experiment stations in the tobacco-growing States and of the United States Department of Agriculture.

Bulletin 96 of the Bureau of Plant Industry, entitled "Tobacco Breeding," by A. D. Shamel and W. W. Cobey, discusses in detail the principles of breeding, and, until exhausted, this publication can be obtained by applying to the Superintendent of Documents, Government Printing Office, Washington, D. C., and inclosing the price, which is 15 cents.

Bulletin 91 of the Bureau of Plant Industry contains some additional cultural advice, particularly in regard to the cigar-tobacco types. This publication can be obtained from the Superintendent of Documents at a cost of 5 cents.

CULTURE OF THE CIGAR TYPES.

Florida Cuban Tobacco.

Cuban varieties when grown in the United States are used primarily for cigar fillers. In certain areas of Florida, Texas, and Connecticut they are grown to a limited extent under shade for cigar wrappers. Our highest class of cigar filler and wrapper tobaccos is usually produced from Cuban seed.

The location selected for the seed bed should have a slightly southern exposure, in order to get the full benefit of the warm rays of the sun in the early spring. The slope should be sufficient to insure perfect drainage at all times, in order to protect the young plants from cold winds and to insure a more rapid growth. It is advisable to inclose the bed with boards 10 or 12 inches wide and to stretch tobacco tenting cloth over the entire bed. The location for the seed bed should be permanent, abundantly fertilized every spring, and kept free from weeds and grass at all times.

The soil should be a rich, friable sandy loam. Before sowing the seed the soil should be dug to a depth of 4 or 5 inches and then thoroughly harrowed and stirred with hand rakes until in a finely pulverized condition. All roots, tufts, and clods of earth should be removed. After this preparation a liberal application of fertilizer containing 10 per cent of ammonia, 8 per cent of phosphoric acid, and 12 per cent of soluble potash is recommended for seed-bed purposes. After applying this fertilizer the soil should be thoroughly stirred and left very smooth, in which condition it is ready for the seed.

The seed should be sown at the rate of about 1 tablespoonful to 100 square feet of seed bed. In order to secure an even distribution it should be thoroughly mixed with wood ashes, corn meal, land

plaster, or commercial fertilizer. It is advisable to sow half the seed lengthwise of the bed and the remainder crosswise. In this way the entire bed will be seeded uniformly. The proper time for sowing the seed is from February 1 to March 1.

Whenever practicable the land should be prepared and the fertilizer applied from one to two weeks before sowing the seed. After sowing, a light roller should be run over the bed or some other means taken to get the soil in a firm, compact condition, in which state it will retain its moisture, thus giving favorable conditions for the germination of seed and for the growth of the young plants. The plants should be made to grow steadily and vigorously without being checked until ready for transplanting. In order to obtain this condition strict and constant attention must be given to watering the bed, keeping down weeds and grass, and preventing the ravages of insect pests. In some cases it is necessary to use an additional application of fertilizer in the way of top-dressing. The necessity for this is often indicated by the plants turning yellow. Some system should be provided for watering the plant beds during spells of dry weather. Water should be applied in the form of a light spray. During the first two weeks of plant growth it is essential that the surface soil be kept comparatively moist at all times, for at this stage a few hours of hot sun after the soil has become dry will be sufficient to kill most of the plants.

One of the most injurious insects to be guarded against is the flea-beetle. The injury to the plants by this insect may be prevented by the use of a light spray of Paris green. This mixture should be made at the rate of 1 pound of Paris green to 100 gallons of water, and should be kept constantly stirred when in use. The same remedy is effective in destroying the hornworm when the seed bed is not covered. The field where the tobacco is to be grown should be plowed and the soil thoroughly pulverized several weeks before the time for transplanting the tobacco.

When grown for wrapper purposes, the following fertilizer has been found very desirable: From 10 to 12 tons of well-rotted stable manure per acre applied before plowing the land, and after plowing 1,000 pounds of cotton-seed meal, 200 pounds of carbonate of potash, 500 pounds of bone meal, and 500 pounds of lime to the acre. The commercial fertilizer should be worked into the soil by thorough stirring before the young plants are transplanted. In transplanting the young plants from the seed bed to the field the largest plants with the best shaped leaves and those showing the most vigorous growth should be used. The ordinary distances for Cuban tobacco are 3 feet 2 inches apart for the rows and 12 inches apart in the row.

Before removing the young plants from the bed the soil should be thoroughly watered to avoid injury by breaking the tender roots of

the plants. Care should be taken in transplanting the plants in the field to avoid bending or doubling the roots. Unless the transplanting is done during wet weather or immediately after a rain, water must be used in order to prevent the plants from dying from the effects of the hot sun and dry soil.

The cultivation of the crop should include the removal of all weeds from the field, particularly during the early stages of growth, and the production of a light, loose mulch on the surface of the soil. It is usually the custom to hoe the young plants twice and to use some form of cultivator once a week during the remainder of the season or until the plants become too large for cultivation. When the plants begin to bud, all except the individual plants saved for seed purposes should be topped. No very definite rule can be given for this process, but it is usually the custom to break off the top of the plant just below the first seed sucker. As a rule the height of the topping must be governed by soil and climatic conditions. It is necessary to remove the suckers before they reach sufficient size to seriously injure or dwarf the plant or interfere in the development of the leaves.

The time for harvesting will depend to a considerable extent upon the season, but the ripeness of the leaves can be distinguished by a thickening and crumbling of the body of the leaves and by the development of light, yellowish patches over the surface.

The manner of harvesting the Cuban tobacco is essentially the same as that practiced in the case of the Connecticut Havana seed. The number of plants to the lath, however, may be increased to 8 or 10 where the growth is comparatively small. Cuban tobacco is seldom primed, except when grown for wrapper purposes under shade. The care of the crop during curing should be the same as with the Connecticut varieties.

After the cured tobacco has been stripped from the stalk it should be fermented in bulk. This sweating process must be watched with unusual care in order to prevent damage to the crop. It is necessary to turn the bulk several times during the process of fermentation in order to keep the temperature at the desired point. The object of turning the bulk is to reverse its construction, thereby bringing the top, bottom, and outside layers into the middle of the new bulk. This plan will permit a uniform fermentation of all the tobacco in the bulk. A convenient and practical size of bulk contains from 2,000 to 3,000 pounds. The temperature of the center of the bulk should in no case be allowed to rise above 120° F., and after the temperature falls 8 to 10 degrees the bulk should be turned. The desirable maximum temperature is 115° F. It takes usually from two to four months to complete the process of fermentation. After fermentation the tobacco must be sized, sorted according to different market grades, tied in hands, and packed in the customary packages.

Texas Cuban Tobacco.

The Texas Cuban tobacco is adapted for cigar filler and wrapper production in southern cigar-tobacco districts. It is particularly recommended for cigar-filler production.

The methods of preparation of the seed bed, the sowing of the seed, and the care of the seed bed should be the same as those recommended for Florida Cuban tobacco.

The seedlings should be transplanted in rows from 3 feet to 3 feet 6 inches apart, and from 12 to 14 inches apart in the row.

The method of fertilizing the land varies with different soils and other conditions, but where the kind and quantity of fertilizer to be used are unknown the following formula may be tried with safety: Ten tons of stable manure, 500 to 1,000 pounds of cotton-seed meal, 250 pounds of high-grade sulphate of potash, 500 pounds of bone meal, and 500 pounds of lime per acre. The amount of bone meal recommended can be reduced without danger.

The methods of culture, topping, and suckering are the same as those used for Florida Cuban tobacco. In harvesting this variety for filler-tobacco purposes, it is the usual plan to cut off the plants when ripe near the ground with a hatchet or by other means, spear them on laths, and hang them in the curing barn to avoid any danger of pole-burn. The methods of handling the curing barn and of fermentation are the same as for other cigar-filler tobaccos. In case a sufficient quantity of this tobacco is grown to warrant fermentation in bulk and the methods of fermentation and packing are unknown and instructions are desired, the growers should communicate with the United States Department of Agriculture direct, when special instructions will be given. This note applies to all of the new and improved varieties of tobacco described in this circular. In order to be of the most service it is necessary that definite instructions be given by letter.

Florida Sumatra Tobacco.

The variety known as Florida Sumatra tobacco is grown almost entirely for cigar-wrapper purposes, and by far the greater portion is grown under shade.

The preparation of the seed bed should be the same as in the case of the Cuban tobacco, and the field should be prepared and cultivated in practically the same manner. This variety of tobacco when grown under shade must be harvested by picking the leaves from the stalk as they ripen, instead of cutting the stalk in the usual manner.

The time for harvesting will depend to a considerable extent upon the season, but the ripeness of the leaves can be distinguished by the development of irregular, light, yellowish colored patches over the surface and a thickening and crumpling of the body of the leaves. The leaves should be harvested before they become overripe, and it is the usual practice to pick them at three or four different periods, the

lower leaves maturing first, the middle leaves next, and the top leaves last, generally allowing from six to eight days between each picking. After picking, the leaves are carried to the curing shed in baskets made for this purpose and are strung on 4-foot laths especially arranged for them, at the rate of 30 to 40 leaves to the lath. The leaves are arranged back to back and face to face, and are regularly strung on the cord attached to the lath. The laths are then hung in the curing shed, where the leaves are allowed to thoroughly cure out.

When the tobacco is primed from the stalk, it should not take more than three weeks to cure; when it is hung on the stalk, from four to six weeks are necessary. The manipulation of the curing barn is governed entirely by the condition of the weather and the nature of the tobacco, so no fixed rules can be given. However, in a general way, it can be said that the barn should be opened during the day and kept closed during the night. If there are frequent showers and but little sunshine, the barn should be kept closed and small fires started, distributed throughout the building. These fires should be continued as long as it is necessary to thoroughly dry out the entire barn of tobacco. Where charcoal is not available, wood which has as little odor and as little smoke as possible should be used. It is very important to dry out the barn without giving the tobacco any foreign odors. To obtain the best results, the tobacco should become fairly moist and fairly dried out once in every twenty-four hours.

When the midribs are thoroughly cured, the leaves are ready to be taken to the packing house. To get the tobacco in condition to handle, all the ventilators should be left open for one night, opening them about 6 o'clock in the evening. The next morning the tobacco should be in what is called "good order," that is, it will have taken up sufficient moisture to make it soft and pliable. The barn is then tightly closed in order to retain the moisture, and the leaves are taken from the laths. The bottom, middle, and top leaves should be kept separate in the barn. After the tobacco has been taken down and packed, it should be hauled at once to the warehouse for fermentation.

The cured tobacco should be fermented in bulk, as in the case of the Cuban variety, but more care is necessary in caring for it after fermentation to meet the market demands. It must be carefully sorted according to color, texture, and body. After sorting, this tobacco is packed into bales, according to the Sumatra custom.

Uncle Sam Sumatra Tobacco.

The Uncle Sam Sumatra variety is adapted for the production under shade of cigar-wrapper tobacco of the Sumatra character. It is the most uniform and most productive variety of cigar-wrapper tobacco. The shape of the leaves is almost ideal for cigar-wrapper manufacture, and when grown under proper conditions the quality is unsurpassed for cigar-wrapper purposes.

This variety is particularly adapted for southern cigar-wrapper districts and for culture under shade. It is now extensively grown in Florida, Georgia, Alabama, and Texas, and experimentally in the Connecticut Valley and other northern districts. The preparation of the seed bed, the sowing of the seed, the handling of the seed bed, and the care of seedlings should be the same as for Florida Cuban and Florida Sumatra tobaccos.

The seedlings should be transplanted in rows from 3 feet to 3 feet 6 inches apart and set from 12 to 16 inches apart in the row. The exact distance of planting, etc., must be governed by the character of the soil, methods of culture, and other conditions.

It will be found that this variety produces but few suckers and but little seed; consequently, the matter of topping and suckering will be found to be less burdensome than in the case of some other varieties grown for cigar wrappers.

The methods of cultivation of the crop, harvesting, curing, and fermentation are the same as for the Florida Sumatra and Cuban varieties.

In the case of the Uncle Sam Sumatra variety, as with other highly bred and specialized varieties, it is necessary to practice the most rigid selection of seed plants every year in order to keep up the type to its high state of excellence. These varieties quickly deteriorate unless careful seed selection is followed. The seed should be saved under bag and carefully separated before sowing.

Improved Connecticut Havana and Cooley Hybrid Tobaccos.

The Improved Connecticut Havana and Cooley Hybrid tobaccos are used for cigar wrappers and cigar binders. The top leaves are frequently used for blending with other fillers for the cheaper grades of cigars.

The seed bed should be located so as to get all possible benefit from the warm rays of the sun and should be protected from the cold north and northwest winds during the early spring days. It is generally advisable to heat the beds, in order to get early seedlings, either by making a manure hotbed or by the use of steam or hot water. The common arrangement of the hotbed framework is 8 feet wide and long enough to provide sufficient seedlings for the field. This is covered with glass sash. The beds should be dug out about 2 feet deep a short time before it is necessary to sow the seed, then filled in with fresh horse manure to a depth of about 1½ feet and the manure covered with a layer at least 6 inches deep of rich, sandy loam soil. About 200 square feet of seed-bed space should be provided for every acre of tobacco.

The soil in the seed bed should be in the best possible tilth before the seed is sown. It is usually advisable to use a highly nitrogenous fertilizer, one of the most common being cotton-seed meal thoroughly

worked into the soil, or, if necessary, a combination of commercial fertilizers, such as nitrate of soda, ground bone, and carbonate of potash. From 1 to 2 tablespoonfuls of seed are used to every 200 square feet of seed bed, and one-half of the seed is usually sprouted before sowing. In sprouting the seed it is mixed with moist apple-tree punk or rotted cocoanut fiber and allowed to stand in a warm room until the sprouts appear. The sprouted seed is then mixed with the dry seed, and in order to get an even distribution over the surface of the beds it is mixed with land plaster or ashes and sown during a calm day. The seed should be covered by lightly raking the surface, care being taken not to cover the seed too deep.

The surface of the seed bed must be kept moist all of the time during the first two or three weeks, for if allowed to become dry all of the tender and delicate young plants will die. Water should be applied in the form of a light spray whenever needed, usually two or three times every day. As the young plants increase in size the beds must be aired frequently in order to prevent the development of fungous diseases. If flea-beetles or other biting insects attack the plants, the bed should be sprayed with a Paris green mixture made of 1 pound of Paris green to 100 gallons of water. In northern districts the seed of this variety is usually sown between March 15 and April 15.

In preparing the land for a tobacco crop it is advisable to grow a cover crop, such as vetch or some other legume, which can be turned under in the spring. The best soil is a sandy loam, which should be fertilized by the application of from 10 to 15 tons of barnyard manure per acre. In addition to the barnyard manure 1,000 pounds of cotton-seed meal, 100 pounds of carbonate of potash, 500 pounds of "starter" (a quickly available complete fertilizer), and a barrel of lime to the acre should be thoroughly worked into the soil with a disk or some other kind of cultivator. In no case should a fertilizer containing chlorin be used for cigar tobacco.

When ready to transplant, the beds should be thoroughly watered before removing the plants, so that they can be pulled without injury to the roots. Care should be taken to discard all irregular and undesirable seedlings and set out only those of uniform size, shape of leaves, and other characters. The Connecticut Havana seedlings should be set in rows 3 feet 3 inches apart and 16 to 18 inches apart in the row. The plants can be set by hand and watered freely in order to get them started to growing as quickly as possible, but if a transplanting machine is available it will probably give the best results.

The field should be cultivated frequently with a surface cultivator in order to maintain a loose, fine soil mulch and to remove all of the weeds. It is usually necessary to loosen the soil about the plants one or more times with a hoe, especially when the plants are small. The cultivation should continue as long as possible, especially during a dry season.

When the seed head begins to develop, the plants are topped; that is, the tops of the plants are broken off in order to promote the development of a broad, thin leaf. The tops are usually removed just below the first seed sucker. Shortly after topping, suckers begin to develop in the axils of the leaves and should be broken off before they injure or dwarf the plants. The suckering process must be repeated frequently during the season in order to keep the plants clean. In the experiments of the Bureau of Plant Industry it has been found that by saving the seed from plants free from suckers it is possible to secure types of tobacco bearing few suckers.

It is difficult to give any directions concerning the proper time to harvest the crop. When the leaves ripen they change in color from a normal dark green to lighter shades, and the leaves increase in thickness and are rough to the touch. Upon bending or folding a ripe leaf it will usually crack or break along the line of the bend. The plants are generally cut off near the ground, just above the worthless sand leaves, with a sharp knife or hatchet. As soon as the plants wilt slightly they are strung on laths, usually from five to six plants to the lath. Each lath is fitted with a detachable sharp iron or steel point, which enables the grower to string the plants on the lath. The laths of plants are then taken to the curing shed and hung so that there will be a circulation of air when the sheds are opened.

The curing process usually takes from four to six weeks, after which the plants can be taken down, stripped, the different grades sorted, and the tobacco packed in cases for fermentation. During the curing process, while the plants are green, the sheds are kept closed at night and during wet weather and open during the day in order to promote the rapid drying out of the leaves and stems. After the plants are practically cured, the sheds are kept closed during the day and open at night and in damp weather.

Halladay Tobacco.

The Halladay variety of tobacco is adapted for the production of cigar wrappers and for growing in northern cigar-wrapper districts. It was originated in the Connecticut Valley, but seems equally promising for Wisconsin, New York, Vermont, New Hampshire, and other northern districts. It is adapted for outdoor culture, and on account of its production of large numbers of leaves it is advised that the leaves be primed and strung in the same way that picked leaves are handled.

The preparation of the seed bed, the sowing of the seed, and the methods of handling the seed bed should be the same as those recommended for Improved Connecticut Havana tobacco.

The preparation of the soil and the field culture should be the same is for the Improved Connecticut Havana variety. The seedlings

should be transplanted in rows about 3 feet 3 inches apart and set from 14 to 16 inches apart in the row. The topping, suckering, and other processes of culture and handling should be followed as in the case of the Improved Connecticut Havana. In harvesting, the sand leaves should be picked or primed when ripe (usually 5 to 7 bottom leaves) and strung at the rate of about 36 leaves to the lath. At least three primings should be made, and, if possible, four are to be recommended in order to get the leaves harvested at more nearly the best stage of ripeness. The curing, packing, and fermentation processes are the same as those for other cigar-wrapper tobaccos.

This is a new and improved variety which should be tested more than one year in order to give it a fair trial. It must be acclimated by careful seed selection where it is to be grown. On account of its productiveness, quality, and other valuable characters it bids fair to become a leading cigar-wrapper tobacco.

Improved Connecticut Broadleaf, Pennsylvania Broadleaf, and Brewer Hybrid Tobaccos.

The methods of sowing the seed, preparing the seed beds, and handling the young plants of the Improved Connecticut Broadleaf, Pennsylvania Broadleaf, and Brewer Hybrid tobaccos, as well as the quantity of seed sown, are practically the same as in the case of Connecticut Havana tobacco. The land is usually fertilized with barnyard manure at the rate of from 8 to 12 tons to the acre and with tobacco stems at the rate of from 500 to 600 pounds to the acre, with little or no commercial fertilizer. Most crops of Broadleaf tobacco are grown by the aid of barnyard manure alone, but in recent years some of the growers have begun to apply cotton-seed meal, carbonate of potash, and tobacco "starter" at the same rate as that used for the Connecticut Havana variety.

On setting out the plants of these varieties, the rows should be arranged 4 feet apart and the plants set from 22 to 24 inches apart in the row. The cultivation of the crop is similar to that for Connecticut Havana tobacco. There is an unusual abundance of suckers produced on most strains of this variety, and it is necessary to remove the suckers several times during most seasons. The methods of harvesting, curing, and arranging this tobacco for market are similar to those followed for the Connecticut Havana variety.

Zimmer Spanish and Little Dutch Tobaccos.

The preparation and care of the seed bed for the Zimmer Spanish and Little Dutch varieties should be the same as for Connecticut Havana tobacco. The rows of plants in the field should be 3 feet apart and the plants set 15 to 20 inches apart in the row. The plants should be topped so as to leave about 16 leaves for each plant, the average yield being about 600 pounds to the acre for the Zimmer

Spanish and 500 pounds to the acre for the Little Dutch. The methods of cultivation, harvesting, and curing are essentially the same as those which are given for the Connecticut Havana tobacco.

Comstock Spanish and Calkins Spanish Tobaccos.

The Comstock Spanish and Calkins Spanish are Wisconsin varieties of tobacco, especially adapted for the production of cigar binders. The directions for preparing the seed bed, sowing the seed, and the culture of the crop are similar to those given for the cultivation of Improved Connecticut Havana and Cooley Hybrid tobaccos. These varieties are adapted to those sections of the United States producing cigar-binder tobaccos.

Hazlewood Cuban Tobacco.

The Hazlewood Cuban, a cigar-wrapper variety, is adapted for growing under shade and can safely be tested in the Connecticut Valley, Florida, Georgia, and other shade-growing sections of the United States where it is desirable to grow a cigar-wrapper tobacco from Cuban seed. It is not especially adapted for growing in the open, but would be a desirable variety to test on a small scale for this purpose.

The methods for preparing the seed bed, sowing the seed, and handling the young plants of the Hazlewood Cuban tobacco are practically the same as in the case of the Connecticut Havana tobacco, and the directions given under the head of Improved Connecticut Havana and Cooley Hybrid tobaccos should be followed for the production of seedlings of this variety.

The cultural methods followed in the case of the Improved Connecticut Havana and Cooley Hybrid tobaccos should be used in cultivating the Hazlewood Cuban variety, with the exception that it is to be grown under shade instead of in the open.

CULTURE OF THE EXPORT AND MANUFACTURING TYPES.

Dark Export Tobacco.

The dark export type of tobacco is grown almost exclusively in western Kentucky, central Virginia, and in several counties of western Tennessee. Its leading characteristics are its dark color, heavy body, and richness in oils and gums. It is cured by open fires of hard wood, which impart to it a characteristic flavor and creosotic odor unlike any other tobacco. A taste for tobacco cured in this manner has been developed in foreign countries, and its keeping quality is much improved by the smoke. This type forms a large proportion of our exports of leaf tobacco and is used in domestic manufacture for snuff, for plug wrappers, and for certain grades of chewing and smoking tobacco. It is grown upon a variety of soils, mostly gray or red, but they may be classified as strong with a high clay or silt con-

tent rather than light. When the topsoil is gray it is usually underlaid not far from the surface by a strong red clay subsoil. A good clover sod is preferred for this type of tobacco, and it should be plowed down during the fall and winter.

SEED BEDS FOR DARK EXPORT TOBACCO.

A well-drained loamy soil that will not suffer from drought, preferably with a southern or eastern exposure, should be selected for the seed bed, and it is the usual custom to select a location in the woods and burn the soil for the purpose of destroying weed seeds and insect life. The bed should not be burned when wet, as burning when in this condition takes more fire and may injure the soil by baking. It usually takes about 4 cords of wood and a quantity of brush to burn 100 square yards of bed. With good fires close to the ground, a given spot can usually be sufficiently burned in twenty or thirty minutes to dry out the soil to a depth of 2 or 3 inches. The bed should then be worked up with a horse cultivator or hoed to a depth of 2 or 3 inches, first raking off the excess of ashes with the back of a rake or hoe. The bed may be fertilized with manure free from grass or weed seeds, but more generally commercial fertilizer is used. If the bed is burned no potash will be required, as there is a sufficiency in the ashes. A good way is to sow the seed in acid phosphate, about 2 quarts to a teaspoonful of seed, and then just before the plants are expected to come up top-dress the bed with nitrate of soda at the rate of 4 pounds for each 25 square yards of bed. A teaspoonful of seed is sufficient for 25 square yards, and the seed should be sowed both ways in order to insure an even distribution. The bed may be burned at any time during the winter when the soil is in condition, and worked up and sowed immediately. In the States where this type of tobacco is usually grown the seeds will not sprout until the soil becomes warm, generally the last of March. The bed should be surrounded with boards about 6 inches wide or logs of about that diameter, and just before the seeds are expected to come up the bed should be covered with plant-bed cloth, the widths being sewn together to fit the bed. Wickets of wire or brush should first have been placed here and there on the bed to prevent the cloth from sagging to the ground. If a moist location has been selected and the soil well prepared and fertilized no further attention will be required ordinarily until the plants are nearly ready to transplant. The canvas should be removed a few days at least before transplanting, in order to toughen the plants so they will withstand the shock of transplanting better. Twenty-five square yards of bed ought to furnish at least 2,500 plants in two drawings, or enough for about a half acre in the field.

It is of course not imperative that a woods location for the bed be selected or that it be burned. On account of the increasing value of

wood and the higher cost of labor there is a tendency on the part of some of the best commercial growers to do less burning than formerly. Any rich, warm, moist but well-drained soil will grow the plants, but they must be kept free from weeds and watered when necessary.

TRANSPLANTING DARK EXPORT TOBACCO.

While the plants are growing, the field to receive them should be put into fine, mellow condition by repeated harrowings with a disk or other suitable harrow. Barn manure is excellent for this type of tobacco, and if used should be well harrowed in. Manure, however, is generally scarce on tobacco farms, and commercial fertilizers are the main reliance in most sections. The usual application is from 100 to 400 pounds per acre of a fertilizer analyzing about 3 per cent of nitrogen or ammonia, 8 per cent of phosphoric acid, and 3 per cent of actual potash. Except on soil of excellent natural fertility, however, this quantity of fertilizer is entirely inadequate to produce a maximum crop. The fertilizer when used in small quantities is usually applied in the hill or row. The rows are laid off about $3\frac{1}{2}$ feet apart with a bull-tongue or turning plow. The fertilizer is then distributed and two furrows are thrown back on the row. This gives a slight elevation above the surrounding soil and in case of heavy rains immediately after setting prevents the drowning of the plants. Check-rowing is frequently practiced on level land. The plants are set in the rows from $2\frac{1}{2}$ to $3\frac{1}{2}$ feet apart, depending upon circumstances and the ideas of the grower. The lesser distance is perhaps more to be advised under ordinary circumstances. The place of setting the plant is marked off along the ridge by cutting through and patting with a hoe or kicking it through with the foot and stepping on it.

Cultivation should begin as soon as the plants show signs of taking hold and should be as thorough and frequent as for any other carefully cultivated crop. It should be discontinued at topping time or when the growth is so large as to prevent working without breaking the leaves.

TOPPING, WORMING, AND SUCKERING DARK EXPORT TOBACCO.

Experience and judgment are necessary in topping tobacco to the best advantage. The object is to force all of the growth into a few leaves and make them larger, thicker, richer, and darker. In some sections, also, it is the custom to prime off from 4 to 6 of the trashy bottom leaves at the time of topping in order to still further improve the quality of the 8 to 12 middle leaves left to mature. The bud, together with several of the top leaves, is usually broken out before the "button" appears, as soon as the desired number of permanent leaves have appeared. The number of leaves allowed to remain depends upon the size and vigor of the plant.

As soon as the suckers appear at the axils of the leaves they should be removed, and it is usually necessary to go over the field for this purpose about once a week. The green hornworm must also be vigorously watched for and removed by hand picking. Paris green is used for killing these worms under some conditions. It can only be used with safety, however, before the tobacco shows any signs of "graining" up. It is almost sure to burn the tobacco if used much after topping has begun on this heavy type of tobacco.

HARVESTING DARK EXPORT TOBACCO.

From thirty to forty days after topping, the plants will usually be ready for harvest. For some time the leaves have been "graining" up and the field has lost the dark green appearance which it had two weeks after topping. The leaf is thick and heavy and the edges have become somewhat yellow and turn under a little all around. It is a nice question to determine when the crop is in the most favorable condition for cutting. If it should stand too long it will deteriorate in weight, elasticity, and soundness. If cut too soon it will lack body and weight and will not cure satisfactorily. When possible to delay, it is best not to cut tobacco within three or four days after a heavy rain, as the gum which accumulates on the leaf in dry weather, and which helps its quality and appearance, is washed off by the rain, and if possible it should be allowed to accumulate again before cutting.

Harvesting by splitting the stalk down from the top to within 2 or 3 inches of the bottom leaves and cutting off just below the bottom leaf and straddling the split stalk over a stick is the common practice. There are some localities where many farmers cut the plant down and allow it to wilt on the ground and then spear it upon the stick. Both methods have their advantages according to circumstances and labor conditions. The splitting of the stalk hastens the curing process by allowing a more ready escape of the moisture from the stalk. From 6 to 10 plants are usually placed upon a stick, depending upon the size and condition of the plants and to a certain extent upon the climatic conditions which are to be expected during the curing process.

To secure a uniform cure, it is important that the tobacco placed in the barn should be cut as nearly at the same time as practicable. Not over two or three days should be consumed, and it would be better if the barn could be filled in one day. In some instances it is probable that the tobacco may have to remain on the scaffold for several days after it is cut; therefore, it should not be crowded on the scaffold, but sufficient space should be left between the sticks so that in the event of rain the air and sun can penetrate and quickly dry out the tobacco. Otherwise the tobacco might be damaged from the moisture held between the leaves.

CURING DARK EXPORT TOBACCO.

The yellowing stage is the first step in the curing process. This change in the leaf is favored and hastened by gentle warmth, moderate moisture, and darkness. It is not customary to use artificial heat in yellowing this type of tobacco, especially when cut early while the weather is warm.

The barns used for this tobacco are comparatively tight and the tobacco may be spaced somewhat closer than in air-curing, because one has the protection of the fires against damage. If the tobacco has been well "killed" on the scaffold it can be placed somewhat closer than if not scaffolded.

In from four to six days after cutting, according to conditions, and after the tobacco is pretty well yellowed, small hard-wood fires over the barn floor are started at frequent intervals. This first firing should be more smoke than heat and is used more as protection against damage and to hasten and complete the yellowing process than for any other purpose. Premature drying of the tips of any leaves not yet fully yellowed should be especially guarded against and the temperature should not be raised above 95° or 100° F. at this first firing; 90° F. for yellowing is a safe rule to go by except in very cool weather, when even that temperature may be too high. After all the green color has disappeared from the leaf and the browning process is well started a somewhat higher temperature may be used if the moisture supply is sufficient to prevent the drying of the leaf before the color changes have taken place. It will not usually be found desirable to allow the temperature to rise above 125° F. More tobacco has been injured by too much than by too little heat. It is the experience of old growers that tobacco cured with little heat will retain its toughness, oil, and luster better and will be easier to "order" than when cured with high temperatures. In curing this type of tobacco the heat should not be maintained continuously, but the fires should be allowed to die down frequently and the tobacco come into order. In very dry weather, when there is no danger of house-burn, fires may better be suspended altogether. A much better color will be secured by this method than by forcing the cure by too much fire. After the leaf and stem are well cured the tobacco will generally need no further attention until it is desired to take it down, perhaps several weeks later. In the event, however, of protracted warm, damp periods, the tobacco should be examined, especially in the middle of the barns, and if soft stems are found and "white" begins to accumulate on the midribs moderate fires must be started and continued long enough to dry it and prevent the spread of damage.

When in soft order, after being thoroughly cured, the tobacco may be taken down for stripping and assorting. For this purpose it

should be in sufficiently good order not to break in handling, but must not be too moist. It is in the right order when the stems are still a little brittle close to the stalk. This type of tobacco is usually assorted into from three to five grades, according to the ideas of the grower and the character of the crop.

White Burley Tobacco.

White Burley tobacco reaches its highest state of perfection on the blue limestone soils of central and northern Kentucky and the adjoining counties of southern Ohio. It is a light-colored and rather light bodied tobacco of exceptionally large absorptive capacity. Its rapid extension in acreage is largely due to this great absorptive capacity for the lower priced liquid sweetenings and flavors used in its manufacture into plug. Its principal use is for manufacturing into plug and twist. There is also a grade of the fine bright or colory leaf suitable for cigarette wrappers that may be selected from some of the best crops. This is the highest grade of Burley leaf. Mason County, Ky., is especially famed for the high quality of Burley leaf produced.

The seed bed may be burned in the woods or in an old pasture or bluegrass field. The bed should be prepared and the seed sown about as for other types, rolling or trampling, or lightly raking and rolling the seed in.

White Burley tobacco is usually grown in rotation with crops of timothy and clover or timothy, clover, and bluegrass, and reaches its highest state of perfection of yield and quality after a heavy bluegrass sod that has stood for several years. This sod should be broken in the fall or during the winter and thoroughly disk-harrowed and fitted in the spring. After a heavy bluegrass sod but little fertilizer or manure is used, nor is much needed, the droppings of the animals which have been pastured and the decay of the heavy sod, together with the high natural fertility of the soil, being considered sufficient to produce an excellent crop. In the absence of these exceptional natural sources of fertility, however, it is probable that manure or fertilizer could be used more extensively and to better advantage than at present. After the breaking up of a heavy bluegrass sod usually two or three crops of tobacco are taken off in succession, a winter cover crop of rye or, preferably, vetch and rye being grown between. After the last tobacco crop is taken the field is seeded to wheat, and then followed by several years of grass again.

Burley tobacco is planted somewhat closer in the row than the dark types, in rows about 3½ feet apart and the plants 18 to 24 inches apart in the row. The cultivation should be of the best, shallow, clean, and frequent.

Burley tobacco is not generally primed at topping time. It is topped, however, at from 14 to 20 leaves, according to the vigor of

the plant at the time of topping, as soon as or just before the bud appears. Suckers and worms must be kept down closely, and for this purpose the field should be gone over frequently until harvest time, which will be in about four or five weeks after topping.

The crop is harvested by splitting the stalk as in the case of dark tobacco and the tobacco is air-cured about as described for other types of air-cured tobacco.

In warm, muggy weather pole-sweat, or house-burn, must be guarded against by airing out or ventilating the barns whenever a favorable opportunity presents itself, or the tobacco must be spread out and given an abundance of room.

After being thoroughly cured, advantage may be taken of damp spells to take down, strip, assort, and prepare the tobacco for market.

Flue-Cured Tobacco.

This type of tobacco is grown extensively and almost exclusively in some of the eastern counties of South Carolina, in the eastern and northern counties of North Carolina, and in southern Virginia. It had a most rapid development and increase in acreage and production during the decade ended in 1900. Its particular uses are for cigarette and pipe smoking mixtures, cigarette cutters, and for plug fillers and wrappers. Its bright color depends upon the soil on which it is grown, the method of curing, and the seed used—of relative importance, probably, in the order named. The present area of production is roughly divided into two belts, the old and the new. The old belt includes most of the area in southern Virginia and the middle and western portions of the North Carolina area. The new belt comprises the eastern counties of North Carolina and extends into northeastern South Carolina.

The new belt with its deeper and lighter sand produces a whiter leaf possessing less body than does the old belt. The lighter colored and lighter bodied tobacco from the new belt yields a larger proportion of leaf suitable for pipe and cigarette smoking mixtures and for cigarette cutters, while the better bodied and less colory tobacco of the western part of the old belt produces more particularly a leaf suitable for plug fillers or wrappers.

A large proportion of this type of tobacco is used in domestic manufacture, although the quantity exported is also of great importance.

The soil can not be greatly enriched for bright tobacco by the use in large quantities of barn manure and of leguminous crops without impairing the bright color of the leaf. Fertilizers, however, are extensively used in amounts varying from 200 to 1,000 or more pounds per acre, analyzing usually about 2 per cent of ammonia, 8 per cent of available phosphorus, and 2 per cent of potash. On

many soils, particularly on the more sandy types, probably more potash can be used to advantage. In many cases also on the poorer soils more ammonia can often be profitably used, but ammonia in excess will darken the tobacco materially and prevent the securing of so bright a color. Cotton-seed meal has been found to be a particularly desirable source of ammonia for bright flue-cured tobacco. A good formula for medium soils for an acre is 400 pounds of cotton-seed meal, 7½ per cent of ammonia, 500 pounds of 14 per cent acid phosphate, and 100 pounds of sulphate of potash (50 per cent actual potash).

The field is usually prepared for setting by bedding as for dark fire-cured tobacco. The rows are made 3½ feet apart and the plants set 2½ feet apart in the row. The tobacco should be topped and kept free from worms and suckers about as for dark or Burley tobacco.

In the new belt most of the tobacco is harvested by priming off the leaves as they ripen, beginning at the bottom of the plant and removing two or three leaves at a time as the field is gone over. The leaves are taken to the barn in baskets or barrows and attached to the sticks in small bunches by means of strings.

In the old belt most of the tobacco is harvested by splitting the stalk and straddling on the stick, as in the dark or Burley types. Flue-cured tobacco should yellow up well on the hill before harvesting. It is important to fill a barn in a single day and if possible have all the tobacco that goes into the barn of a uniform degree of ripeness. Small, tightly daubed log houses about 16 feet square are generally used for this type of tobacco. They are fitted with a system of sheet-iron flues, usually with two furnaces of brick or stone and a single return or, more generally, two returns. The flues, 10 or 12 inches in diameter, thus cross the barn four times and make the flues in a 16-foot barn about 4 feet apart. To successfully cure tobacco by the flue process under various conditions requires much experience. The general procedure under average conditions, however, is about as follows:

Moderate fires are started as soon as the barn is filled or on the day following, maintaining a temperature of from 90° to 100° F. from eighteen to thirty-six hours, until the tobacco is pretty thoroughly yellowed. The fires are then slowly raised about 5 degrees in two hours, until 120° F. is reached, and held at that point about six hours, until the leaf itself is nearly cured. The stalk is then cured by advancing about 5 degrees per hour until 180° F. is reached, at which point it is maintained until the stalk is entirely cured. The procedure varies somewhat in different localities according to the character of tobacco produced and according to different men's ideas. As the cure progresses the tobacco is characterized usually by a pale pea-green color. This, however, will largely disappear after the heat is

removed and the tobacco comes in soft order. About four days are usually consumed in curing a barn of flue tobacco, and the barns are filled several times over by the larger farmers. The tobacco will usually come in moderate order the next morning after the fires are stopped. It may then be taken down and bulked on the stick in any building where it is protected from the weather. It can then be stripped and assorted and prepared for market when weather conditions will permit of its being handled without breaking. Many farms have ordering cellars where the tobacco can be put into condition for handling at any time.

Virginia Sun-Cured Tobacco.

The production of Virginia sun-cured tobacco is confined almost exclusively to a few counties in the neighborhood of Richmond, Va., on the north. Its principal use is for plug and twist fillers and wrappers. In the typical sun-cured product the tobacco is scaffolded in the open air or sun near the curing barn, being allowed to remain on the scaffold crowded rather closely together for five or six days, until thoroughly yellowed. It is then opened somewhat to prevent damage to the lug leaves and allowed to remain on the scaffold three or four days more until well under way in the curing process. It is then placed in the barn and the curing process finished as with any air-cured tobacco. Rain during the first two or three days on the scaffold will not injure it if it is opened up as soon as it clears to allow the moisture to dry out between the plants. After it has yellowed much, however, rain will damage it, and on the appearance of rain it must be promptly put in the barn or shed until the wet weather is over. This exposure to the sun is thought to sweeten and improve its flavor for chewing purposes. As a matter of fact, however, due to the increased cost of labor and greater expense in handling, the typical sun-curing process is now but little practiced, and tobacco in the so-called sun-cured district of Virginia is generally hung directly in the barn and cured in about the same way as any other air-cured tobacco. Except for the modification in curing as noted, the methods of growing plants, setting, fertilizing, cultivation, topping, suckering, worming, and harvesting are in all essential respects about as for the dark fire-cured tobaccos. Sun-cured tobacco is set in rows about 3 or $3\frac{1}{2}$ feet apart and $2\frac{1}{2}$ feet apart in the rows, i. e., from 5,000 to 6,000 plants to the acre.

Green River and Upper Cumberland Tobacco.

This type of tobacco is grown along the Green and Upper Cumberland rivers in Kentucky and across the Tennessee line and on its northern limits across the Ohio River in the adjoining counties of Indiana. The character of leaf in the lower Green River district is somewhat different from that produced in the upper Green River and Upper Cumberland sections, but it is nearly all air-cured and

suitable for domestic manufacture into plug and twist for chewing and for smoking purposes. Except that it is air-cured its methods of production are very similar to those used in producing the dark fire-cured types.

Maryland Smoking Tobacco.

Nearly all of the tobacco grown in Maryland is produced in the five counties of the State constituting what is known as southern Maryland, situated between the Potomac River and Chesapeake Bay.

This type of tobacco, typically of light body and color, is rather deficient in gum and oil and is particularly noteworthy because of its ready burning quality. It is used primarily for export purposes, France being the principal consumer, but considerable quantities going also to Holland and Germany. In these countries it is used principally for pipe and cigarette purposes. A small part of the production is used also in domestic factories for certain smoking mixtures.

The soil upon which this type of tobacco is produced is of a silty or sandy nature, the soil and subsoil of a gray or yellowish color, generally rather deficient in humus and of moderate fertility.

Stable manure is but scantily available, but when used gives excellent results. Fertilizers of a low grade are quite generally used in small quantities. They could probably be used to much better advantage than at present.

Maryland smoking tobacco is planted in rows, usually checked, about 3 feet or 2 feet 9 inches each way. The manner of setting and cultivation is about the same as for other varieties. No leaves are primed off at topping time, and this tobacco is topped higher than the dark and Burley types. From 16 to 25 leaves are generally left, according to the vigor of the plant. This tobacco should be kept suckered and wormed, and is ready for harvest about four weeks after topping. On account of the greater length of stalk and the larger number of leaves it is not practicable to harvest Maryland tobacco by splitting the stalk. The plants are cut close to the ground with a heavy knife or hatchet, and after wilting a short time are speared on a stick by means of a sharp point placed over the end. Maryland tobacco is air-cured about as described for other types of air-cured tobacco.

GENERAL REMARKS.

Tobacco will grow well in almost any soil if made reasonably fertile and in almost any climate that will produce good crops of corn or cotton, but it is only under certain favorable conditions of soil, climate, and handling that it possesses the peculiar points of excellence which make it commercially valuable. Proper handling, especially from the topping season on through the curing process and preparation for market are very important factors, and even with

the proper soil and climatic conditions the inexperienced grower is not likely to achieve much success. It is also a noteworthy fact that even in the hands of experienced men it is a tedious and discouraging task to introduce the successful commercial cultivation of tobacco into new areas, even though climate and soil conditions seem to be very favorable.

Tobacco makes a very large growth in a short period of time, is able to utilize large amounts of readily available plant food, and as a general rule it should be liberally fertilized or manured. The rainfall or other source of moisture supply should be well distributed, but should not be excessive.

Fertilizers when used in large quantities should not be concentrated in a mass directly under the plant, but should be broadcasted or scattered the entire length of the row and thoroughly mixed with the soil before planting by running a cultivator or other suitable implement along the row.

After cutting, it is customary to let the tobacco lie on the ground for a time to wilt before scaffolding or hauling to the barn. It should be remembered, however, that the intensely hot sun of midday in August will often sunburn tobacco as it lies on the ground in thirty minutes or less, and of course all the leaves or portions of leaves so affected are absolutely ruined. To prevent this the tobacco may be turned over if not sufficiently wilted or the sticks may be made into small piles or, better still, the tobacco should be scaffolded or hauled to the barn before it sunburns.

Care should be exercised not to bruise the tobacco in hauling. Bruises are permanent injuries and no subsequent care can remove them.

When the tobacco is intended for home consumption the air-curing or sun-curing process will usually be found the most satisfactory method, no matter what variety of seed is used. It should be remembered, however, that curing is not mere drying. It takes both warmth and moisture to properly cure tobacco, and the leaf should not be allowed to dry so rapidly as to exhaust the moisture from it before the desired color changes have taken place. It should be hung in the barn close enough to retain its moisture sufficiently for curing purposes, but not so close as to cause sweating or house-burning. So far as possible the barns should be alternately aired out or closed to properly maintain the balance between too rapid drying and damage from excessive moisture. It is next to impossible to properly cure any type of tobacco by any practicable process in the cool dry weather of late fall. The temperature is too low for the color changes to take place readily and the air contains so little moisture that the application of heat results in too rapid drying.

O